Body Size and Physique Among Canadians of First Nation and European Ancestry

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ABSTRACT The purpose of this study was to compare body size and physique among Canadians of Aboriginal (First Nation [FN]) and European ancestry (EA) from the northern Ontario communities of Temagami and Bear Island. The sample consisted of 130 FN and 494 EA participants including adults (20–75 years: 214 men, 234 women) and youth (5–19 years: 97 boys, 79 girls). Indicators of body size and physique included stature, the sitting height–to-stature ratio (SSR), body mass, BMI, estimated upper-arm muscle area, biacromial, bicristal, biepicondylar, and bicondylar breadths, and the Heath-Carter anthropometric somatotype (endomorphy, mesomorphy, and ectomorphy). There were few differences in body size between FN and EA, with the exception of adult females. Adult FN females were significantly heavier and had greater bone breadths than EA women ($P < 0.001$). On the other hand, somatotype differed significantly between EA and FN by age and sex, except for 5–19-year-old females. Among boys and men, FN had greater endomorphy ($P < 0.03$), whereas FN men also had lower ectomorphy ($P < 0.01$). Among women, FN were significantly more endomorphic and mesomorphic and less ectomorphic ($P < 0.001$). Although results for 5–19-year-old females were not significant, they were in the same direction as the other groups (greater endomorphy). Forward stepwise discriminant function analyses indicated that endomorphy was the most important discriminator between FN and EA by age and sex. Am J Phys Anthropol 108:161–172, 1999. © 1999 Wiley-Liss, Inc.

The anthropometry of Aboriginal (First Nation[1]) Canadians has in general been understudied. Several reports have been published on the anthropometry of populations living in the circumpolar regions of North America (Jamison and Zegura, 1970; Auger et al., 1980; Rode and Shephard, 1973, 1984, 1994); however, studies of body size and physique among the First Nation groups living in the subarctic and more temperate regions of Canada are limited. The lack of information on the body size and physique of First Nation Canadians represents a lacuna in our understanding of Aboriginal growth, susceptibility to chronic disease, and theories of adaptation and peopling of the New World.

Grant (1929, 1930) published two detailed anthropometric reports describing the body size and proportions of Native Canadians living in the neighborhood of Lake Athabasa

[1]The First Nation are Aboriginal Canadians—those people who are "Status Indians" under the Indian Act (i.e., descendants of the men who signed treaty with the Crown). The First Nations correspond to Indians denoted on tribal rolls in the United States.

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(Athapaskans and Cree) and in northern Manitoba (Cree and Ojibwa). Similarly, the growth and adult size of Athapaskan and Pacific Coast (Nootka) Indians have also been described in the context of nutritional surveys (Birkbeck et al., 1971; Lee and Birkbeck, 1977). Additional information on the body size of First Nation Canadians is available in reports where anthropometry was tangential to the focus of the research (Hurlich and Steegmann, 1979) or where anthropometry was an integral part of the research question (Szathmáry and Holt, 1983; Macaulay et al., 1997).

Physique, or the overall configuration of the body, is generally assessed using the somatotype. Presently, the most commonly used method of estimating physique is the Heath-Carter anthropometric somatotype (Carter and Heath, 1990). To the authors' knowledge, no studies of somatotype have been reported on the Canadian First Nation groups, which limits discussions regarding the physique of these groups relative to other populations in North America.

Given the dearth of information on the body size and physique of the Canadian First Nation groups, the purpose of this study was to compare body size and physique of Canadians of First Nation (FN) and European ancestry (EA) from northern Ontario. The results are presented here for comparison with previous and future publications which include the anthropometry and physique of FN Canadians.

MATERIALS AND METHODS

Ethnographic background

The northern Ontario town of Temagami and FN community of Bear Island were selected as the sites for this study (47°N latitude, 80°W longitude). Temagami is located along a provincial highway, while Bear Island is a FN Reserve located 24 km southwest of Temagami by water. The Temagami FN, the Teme-Augama-Anishnabai (the people of the deep water), traditionally Algonkian speakers, are Ojibwa, one of the largest and most widely distributed of the Canadian FN groups. A study of the genetics of central Algonkians indicates that the Ojibwa and their neighbors, the Cree, are very similar, and these similarities are likely the result of the two groups sharing a recent common ancestoral population (Szathmáry and Auger, 1983). The Teme-Augama-Anishnabai have documented 6,000 years of occupation of their homeland, N'Daki Menan (Teme-Augama-Anishnabai, 1990). Their homeland at the time of European contact encompassed approximately 3,800 square miles around Lake Temagami; however, the band was small, numbering fewer than 200 people (Hodgins and Benidickson, 1989). The population of Bear Island in 1913 consisted of 95 people (Speck, 1915).

The earliest European contacts in the Temagami area were through the fur trade, and by the late 1800s the Hudson's Bay Company was established in the area (Mitchell, 1977). Following the fur trade, the late nineteenth century saw lumbermen, missionaries, prospectors, railwaymen, sportsmen, and canoeists entering the area (Hodgins and Benidickson, 1989). From this point on, resource extraction and tourism have become the main industries of Temagami.

Sample and measures

Data were collected during the spring and summer of 1996 (May–August). The sample consisted of 130 FN and 494 EA participants. The sample was divided into adults (20–75 years: 214 men, 234 women) and youth (5–19 years: 97 boys, 79 girls). Participants were recruited by telephone, door-to-door visits, and letters sent home from the principal of the public school (for children 5–15 years) as well as by advertising using signs placed around the town. The protocol for the data collection was approved by the University Committee for Research Involving Human Subjects (UCRIHS) at Michigan State University, the Temiskaming Board of Education, the Township of Temagami Town Council, and the Temagami First Nation. Informed consent was obtained from all participants. The response rate for the study could not be determined due to the variety of recruitment strategies employed. However, the sample ($n = 624$) represented approximately 50% of the total population living in the area (Table 1). The population of the Township of Temagami was estimated at 1,030 people in 1993 (Statistics Canada,

TABLE 1. Age and sex distribution of participants compared to reported populations of Temagami and Bear Island

Age group (years)	Number of residents[1]	Participants			% partici-pation
		Males	Females	Total	
Temagami					
<15	200	65	55	120	60.0
15–29	170	55	43	98	57.6
30–44	230	68	81	149	64.8
45–64	300	65	68	133	44.3
≥65	130	16	22	38	29.2
Total	1,030	269	269	538	47.6
Bear Island					
<15	28	12	6	18	64.2
15–29	52	12	15	27	51.9
30–44	37	6	10	16	43.2
45–64	38	10	10	20	52.6
≥65	19	2	3	5	26.3
Total	174	42	44	86	49.4

[1] Data from Statistics Canada (1995) and Temagami First Nation Band records.

1995), while the population of Bear Island was 174 people in 1997 (FN Band Records). The participation rates were similar in Temagami (47.6%) and Bear Island (49.4%). The population of Bear Island is predominantly FN, while the population of Temagami is predominantly EA; however, some FN live in Temagami, and some EA live on Bear Island. No records of population sizes based on ethnicity exist. There is no estimate of the degree of admixture for the FN, and participants were assigned to either the FN or EA group based on self-ascribed ethnic status.

A battery of anthropometric dimensions was taken on each subject following the standardized procedures of Lohman et al. (1988). Stature was measured to the nearest millimeter using a field anthropometer (GPM, Seritex, Inc., Carlstadt, NJ), and body mass was assessed to the nearest 0.2 kg using a standing spring scale (Medixact Proshape; Sunbeam-Oster, Schaumburg, IL). Skinfolds at the triceps, subscapular, supraspinale, and medial calf sites were measured with a Holtain (Holtain LTD, Crymych, UK) caliper to the nearest 0.2 mm. Biacromial, bicristal, and bicondylar breadths were measured with the upper end of the anthropometer to the nearest millimeter, and a small sliding caliper (GPM) was used to measure biepicondylar breadth to the nearest millimeter. Relaxed and flexed mid-upper arm and maximal calf circumferences were measured to the nearest millimeter with a flexible fiberglass tape. All measurements were taken on the right side of the body.

The body mass index (BMI) (meters/square kilogram), the sitting height–to-stature ratio (SSR) (%), and estimated upper-arm muscle area (UMA) (square centimeters) were calculated. Estimated UMA was calculated from relaxed arm circumference and the triceps skinfold following Frisancho (1990):

$$\text{UMA} = (C - T\pi)^2/4\pi,$$

where C is the mid-upper arm circumference (in centimeters) and T is the triceps skinfold (in centimeters).

Heath-Carter somatotypes were derived for each individual from the anthropometric dimensions using the equations of Carter and Heath (1990). For endomorphy, the equation was

$$\text{A. Endomorphy} = -0.7182 + 0.1451(X) - 0.00068(X^2) + 0.0000014(X^3),$$

where X = [(triceps (millimeters) + subscapular (millimeters) + supraspinale (millimeters) skinfolds) × (170.18/stature (centimeters)]. For mesomorphy, the equation was

$$\text{B. Mesomorphy} = [0.858 \times \text{biepicondylar breadth (cm)}] + [0.601 \times \text{bicondylar breadth (cm)}] + [0.188 \times \text{CAG})] + [0.161 \times \text{CCG}] - [\text{stature (cm)} \times 0.131] + 4.50,$$

where CAG (corrected arm girth) = flexed arm circumference (centimeters) - triceps skinfold (centimeters) and CCG (corrected calf girth) = maximal calf circumference (centimeters) - medial calf skinfold (centimeters). For ectomorphy, the equation was

$$\text{C. Ectomorphy} = \text{SMR} \times 0.732 - 28.58,$$

where SMR (stature mass ratio) =

$$\frac{\text{stature (cm)}}{\sqrt[3]{\text{mass (kg)}}}$$

TABLE 2. Intraobserver technical errors of measurement (TEMs) and intraclass correlations for the anthropometric dimensions and estimated somatotype components

Measure	n	TEM[1]	r_{intra}
Stature	64	0.54 cm	1.000
Sitting height	63	0.95 cm	0.997
Body mass	64	0.72 kg	1.000
Skinfolds			
Triceps	63	0.94 mm	0.994
Subscapular	63	1.03 mm	0.994
Supraspinale	63	1.34 mm	0.986
Medial calf	60	1.11 mm	0.984
Breadths			
Biacromial	64	0.57 cm	0.995
Bicristal	64	0.58 cm	0.993
Biepicondylar	64	0.10 cm	0.995
Bicondylar	63	0.18 cm	0.989
Circumferences			
Relaxed arm	64	0.51 cm	0.996
Flexed arm	64	0.40 cm	0.998
Maximal calf	60	0.34 cm	0.998
Somatotype			
Endomorphy	63	0.20	0.995
Mesomorphy	60	0.17	0.993
Ectomorphy	64	0.13	0.995

[1] TEM, technical error of measurement.

If SMR $<$ 40.75 but $>$ 38.25, ectomorphy = SMR $\times$ 0.463 - 17.63. If SMR $\leq$ 38.25, a value of 0.1 is assigned.

If the calculation of any somatotype component is zero or negative, a value of 0.1 is assigned (Carter and Heath, 1990).

Reproducibility of measurements

Replicate anthropometric measurements were made approximately 10 days apart on 64 individuals, and the repeatability of the measurements was estimated using the technical error of measurement (TEM) (Malina et al., 1973):

$$TEM = \sqrt{d^2/2N}$$

where d is the difference between replicate measurements and $2N$ is twice the number of pairs.

The TEMs for the anthropometric dimensions and estimated somatotype components are presented in Table 2. The TEMs for the anthropometric dimensions are well within the range for those reported for major national surveys in the US (Malina, 1995). In addition, the TEMs for the somatotype components were $<$0.20, which are comparable to the errors reported for the Québec Family Study ($<$0.3 units) (Bouchard, 1985).

Statistical analysis

Differences in anthropometry between FN and EA were ascertained using ANCOVA, with age as the covariate, within age and sex groups as described above. Additionally, Heath-Carter anthropometric somatotypes were compared between FN and EA using the protocol of Cressie et al. (1986). Since somatotype is a three-component index, each component should not be considered an independent variable. The first step in the somatotype analysis was to perform an overall MANCOVA between groups, with age as a covariate. Univariate F-tests were then performed to determine which components contributed to the significant difference. Finally, forward stepwise discriminant function analyses were performed to determine which somatotype components best discriminated between the two groups.

RESULTS

Body size

Age and anthropometric characteristics of the sample are summarized in Table 3. In general, there are few differences among FN and EA, with the exception of adult females. Adult FN females have significantly greater body mass, BMI, and skeletal breadths than EA females, although mean stature and the SSR do not differ between the groups.

Growth in stature and body mass in boys and girls 5–19 years of age are plotted relative to Canadian reference data (Fitness Canada, 1985) in Figures 1 and 2. Stature of FN and EA males is between the tenth and ninetieth percentiles until about age 12, when it increases relative to the reference data in EA males and approximates the median in FN males. In females, stature generally falls between the tenth and ninetieth percentiles of the reference data, and age-group means (not shown) approximate the median. Body mass in EA males follows the same pattern as stature. It approximates the fiftieth percentile until about age 12 and then begins to climb relative to the reference data (Fig. 2). Variability in body mass is generally greater than in stature, with several individuals exceeding the ninetieth percentile for body mass in all age-by-sex groups.

TABLE 3. Descriptive anthropometric characteristics of the sample by age, sex, and ethnicity[1]

	First Nation			European ancestry			Ethnic difference[2]	
	n	$\overline{X}$	SD	n	$\overline{X}$	SD	F ratio	*P*
Males, 5–19 years								
Age (years)	22	11.7	4.7	75	10.5	4.1	1.20	0.3
Stature (cm)	22	150.4	24.0	75	142.3	25.5	0.84	0.4
SSR (%)	22	52.2	1.8	74	52.7	1.9	0.46	0.5
Mass (kg)	21	46.9	21.0	75	40.6	21.0	3.39	0.07
BMI (kg/m^2)	21	20.1	4.0	75	18.5	3.6	2.62	0.1
Biacromial breadth (cm)	22	35.2	6.3	74	32.6	6.1	5.17	0.03
Bicristal breadth (cm)	21	24.4	4.6	74	23.7	4.6	0.01	0.9
Biepicondylar breadth (cm)	22	6.2	0.9	75	5.8	0.9	2.77	0.1
Bicondylar breadth (cm)	21	8.6	1.1	75	8.4	1.2	0.29	0.6
UMA (cm^2)	21	31.4	11.8	75	29.3	14.0	0.04	0.8
Males, 20–75 years								
Age (years)	35	38.6	13.5	179	43.9	14.3	4.07	0.05
Stature (cm)	35	175.8	5.6	179	175.5	7.3	0.29	0.6
SSR (%)	35	52.6	2.0	179	52.3	1.5	0.71	0.4
Mass (kg)	35	87.2	13.6	178	83.6	15.5	2.28	0.1
BMI (kg/m^2)	35	28.2	3.8	178	27.2	4.7	3.65	0.06
Biacromial breadth (cm)	35	43.9	2.5	178	43.2	2.5	0.79	0.4
Bicristal breadth (cm)	35	32.5	2.4	178	31.9	2.6	3.43	0.07
Biepicondylar breadth (cm)	35	7.4	0.4	179	7.3	0.5	3.76	0.05
Bicondylar breadth (cm)	35	10.0	0.7	177	9.8	0.7	2.37	0.1
UMA (cm^2)	35	66.0	13.6	177	64.3	12.6	0.30	0.6
Females, 5–19 years								
Age (years)	19	12.2	3.7	60	11.1	4.2	1.07	0.3
Stature (cm)	19	149.4	17.3	60	142.1	21.8	0.79	0.4
SSR (%)	18	53.1	1.5	60	52.8	1.4	1.29	0.3
Mass (kg)	19	47.2	21.7	60	40.5	20.3	1.41	0.2
BMI (kg/m^2)	18	19.3	3.4	60	18.7	4.3	0.13	0.7
Biacromial breadth (cm)	19	34.2	4.6	59	32.4	4.8	1.61	0.2
Bicristal breadth (cm)	19	25.7	4.0	59	24.2	4.5	0.76	0.4
Biepicondylar breadth (cm)	19	5.7	0.6	59	5.5	0.7	0.91	0.3
Bicondylar breadth (cm)	18	8.0	0.6	59	8.0	1.1	0.09	0.8
UMA (cm^2)	17	27.2	7.0	59	26.2	10.8	0.25	0.6
Females, 20–75 years								
Age (years)	54	38.8	13.8	180	45.0	13.8	8.31	0.004
Stature (cm)	54	162.8	5.6	180	161.9	5.9	0.12	0.7
SSR (%)	54	52.9	1.3	177	53.0	1.4	1.16	0.3
Mass (kg)	54	75.7	14.5	178	68.5	15.2	11.39	0.001
BMI (kg/m^2)	54	28.6	5.4	178	26.1	5.5	11.98	0.001
Biacromial breadth (cm)	54	39.5	1.8	178	38.2	2.0	16.94	<0.001
Bicristal breadth (cm)	54	32.5	2.8	179	31.1	2.9	17.72	<0.001
Biepicondylar breadth (cm)	54	6.6	0.5	180	6.4	4.5	17.45	<0.001
Bicondylar breadth (cm)	54	9.6	1.0	178	9.3	1.0	7.04	0.009
UMA (cm^2)	51	40.3	7.1	178	38.9	8.4	1.71	0.2

[1] $\overline{X}$, mean. UMA, mid-upper arm muscle area; BMI, body mass index; SD, standard deviation; SSR, sitting height to stature ratio.
[2] ANCOVA, with age as the covariate, with the exception of age, which was compared using ANOVA.

Physique

Table 4 presents the mean somatotypes for the sample by age group and sex. Somatotypes differ significantly between FN and EA male youth (P = .002), adult males (P = 0.04), and adult females ($P < 0.001$). The MANCOVA for female youth is not significant (P = 0.098). Post-hoc pairwise comparisons indicate that FN boys are significantly more endomorphic than EA boys (P = 0.004). FN adult males are significantly more endomorphic (P = 0.03) and less ectomorphic (P = 0.01). FN adult females are significantly more endomorphic ($P < 0.001$) and mesomorphic ($P < 0.001$) and less ectomorphic ($P < 0.001$). Nonsignificant differences in somatotype between EA and FN female youth are in the same direction as the significant differences in male youth and in adults (greater endomorphy in FN).

Forward stepwise discriminant function analyses indicate that endomorphy is the best discriminator between FN and EA by age and sex (Table 5). Significant results were obtained for each age and sex group with the exception of adult males in which

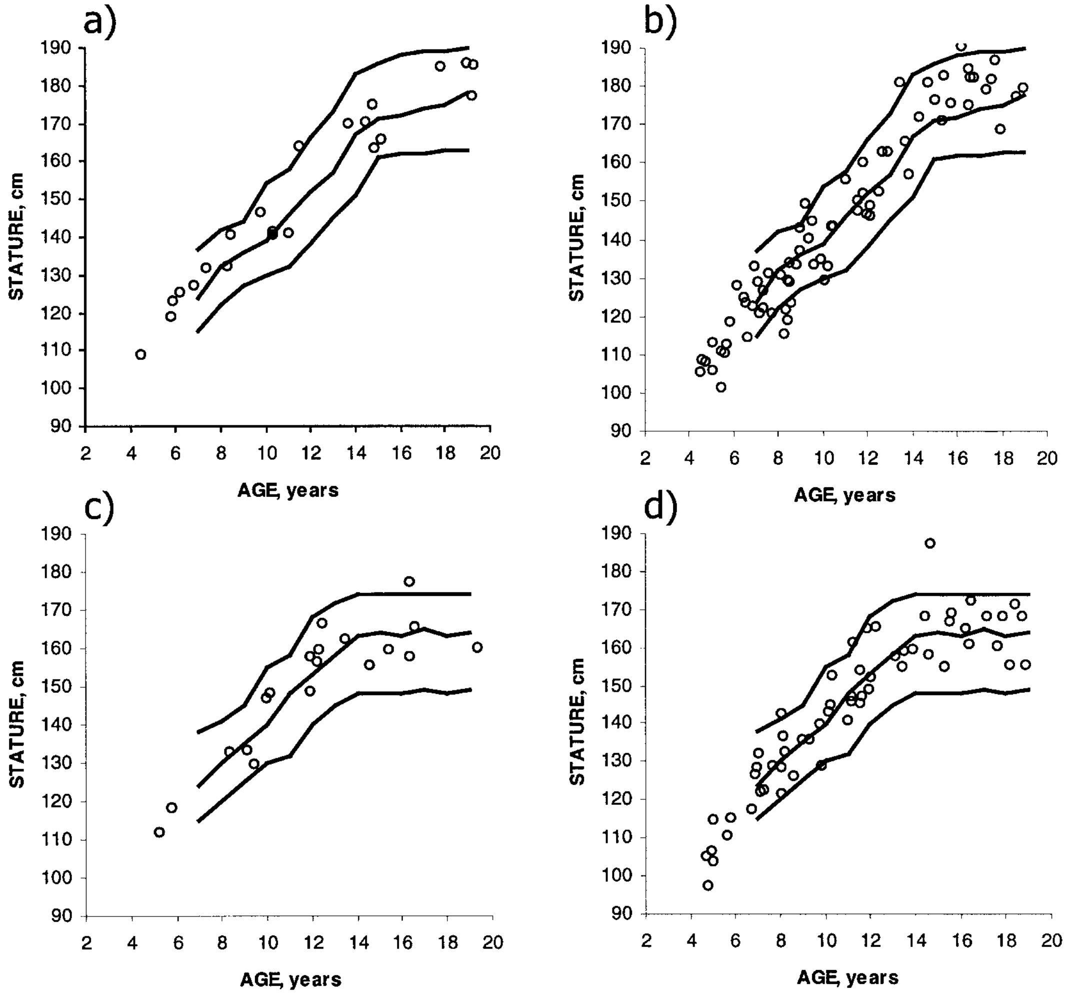

Fig. 1. Comparison of growth in stature in Temagami males of First Nation (**a**) and European (**b**) ancestry and Temagami females of First Nation (**c**) and European (**d**) ancestry with tenth, fiftieth, and ninetieth percentiles of Canadian reference data (Fitness Canada, 1985).

endomorphy was the best discriminator, although the discriminant function was not significant ($P = 0.22$). Once endomorphy is accounted for, there is no clear pattern in the order which mesomorphy and ectomorphy enter the analyses.

DISCUSSION

Body size

There are few anthropometric differences between EA and FN in the present study, with the exception that FN adult females are heavier and have greater skeletal breadths than EA females. There are several sources of comparative data for stature, sitting height, and body mass from samples of Aboriginal groups in Canada (Table 6). The present sample of Ojibwa from Temagami is at the upper end of the distribution of body size in the available samples. Female stature (162.9 cm) is greater than any other reported stature in First Nation Canadians. The Temagami FN males are also tall (175.8 cm), with mean stature which is similar to the Meagamow Cree (175.6 cm) reported by Hurlich and Steegmann (1979). Similarly, body mass in the present sample is higher than has been reported before.

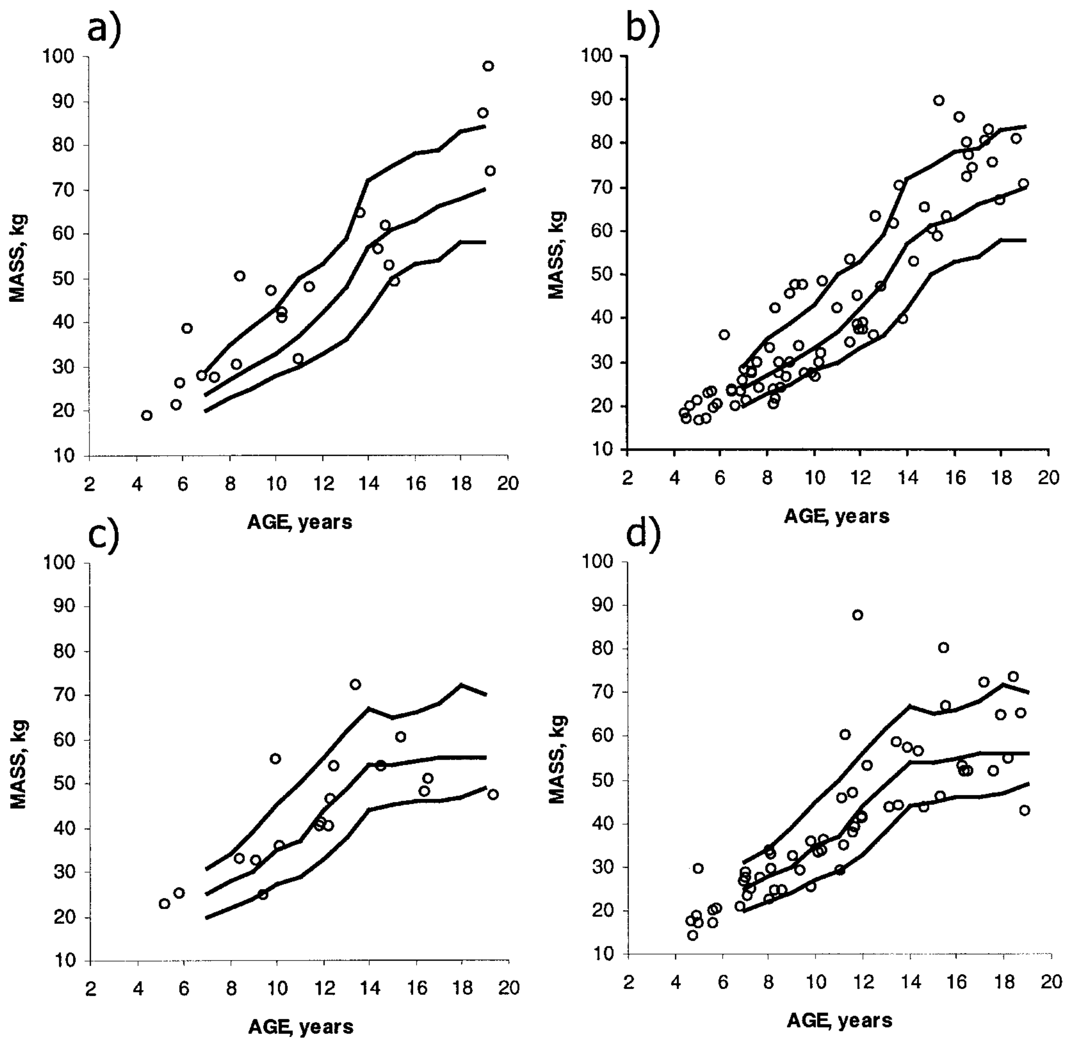

Fig. 2. Comparison of growth in body mass in Temagami males of First Nation (**a**) and European (**b**) ancestry and Temagami females of First Nation (**c**) and European (**d**) ancestry with tenth, fiftieth, and ninetieth percentiles of Canadian reference data (Fitness Canada, 1985).

Mean female body mass (75.7 kg) is 10 kg higher than any reported in the literature for First Nation women. Similarly, male body mass (87.2 kg) is 7.6 kg higher than the Nootka, the second heaviest sample of males in Table 6. The high values for body mass are reflected in high prevalences of overweight, using the eighty-fifth percentile for BMI (NHANES II) as the criterion. Among the Temagami FN, prevalences of overweight are 28.6% and 51.4% in males and 29.4% and 60.0% in females for youth and adults, respectively (Katzmarzyk and Malina, 1998). These results are consistent with those of Young and Sevenhuysen (1989), who indicated that 90% of females 45–54 years of age had BMIs greater than 26 kg/m^2 among the Cree and Ojibwa of northern Canada, with high rates of overweight in all age and sex groups.

Sitting height in the present sample of FN is also at the upper end of the distribution of values presented in Table 6. On the other hand, the SSR is not different than the

TABLE 4. Anthropometric somatotypes of sample by age, sex, and ethnicity

Group	First Nation			European ancestry			Ethnic difference[2]		
	n	$\bar{X}$	SD	n	$\bar{X}$	SD	Wilks λ	F ratio	*P*
Males, 5–19 years									
Somatotype	—	—	—	—	—	—	0.85	5.30	0.002
Endomorphy	21	4.5	2.2	72	3.2	1.5	—	8.84	0.004
Mesomorphy	21	4.7	1.2	72	4.6	1.1	—	0.47	0.49
Ectomorphy	21	2.4	1.4	72	2.7	1.4	—	1.14	0.29
Males, 20–75 years									
Somatotype	—	—	—	—	—	—	0.96	2.82	0.04
Endomorphy	35	5.2	1.5	57	4.6	1.8	—	5.13	0.03
Mesomorphy	35	6.2	1.4	57	6.0	1.7	—	1.83	0.18
Ectomorphy	35	1.0	0.9	57	1.4	1.2	—	6.15	0.01
Females, 5–19 years									
Somatotype	—	—	—	—	—	—	0.91	2.18	0.10
Endomorphy	18	4.8	1.9	57	4.1	1.6	—	1.49	0.23
Mesomorphy	18	3.7	1.6	57	4.0	1.2	—	0.50	0.48
Ectomorphy	18	2.7	1.7	57	2.7	1.4	—	0.01	0.93
Females, 20–75 years									
Somatotype	—	—	—	—	—	—	0.91	6.19	<0.001
Endomorphy	43	7.4	1.9	161	6.1	1.8	—	17.71	<0.001
Mesomorphy	43	5.9	1.8	161	5.1	1.7	—	10.76	0.001
Ectomorphy	43	0.7	1.0	161	1.3	1.2	—	16.51	<0.001

[1] SD, standard deviation; $\bar{X}$, mean.
[2] Differences in overall somatotype determined by MANCOVA, with age as the covariate, while differences in individual somatotype components determined by univariate F-tests (ANCOVA), with age as the covariate.

TABLE 5. Summary of forward stepwise discriminant function analyses for ethnic differences in somatotype[1]

Group	Step 1	Step 2	Step 3	Wilks λ	*P*
Males					
5–19 years	Endomorphy (8.92)	Ectomorphy (6.53)	Mesomorphy (0.15)	0.85	0.002
20–75 years	Endomorphy (3.17)	Mesomorphy (1.67)	Ectomorphy (1.12)	0.98	0.22
Females					
5–19 years	Endomorphy (2.44)	Mesomorphy (5.58)	Ectomorphy (<0.00)	0.90	0.02
20–75 years	Endomorphy (15.48)	Ectomorphy (0.33)	Mesomorphy (0.54)	0.92	0.001

[1] Entries show the component entered on each step and the f-value to enter.

values for EA (Table 3). The SSR in the present sample of FN males is 52.6%, which is similar to the value of 53.0% from a nationally representative sample of Canadian FN 20–29 years of age (Nutrition Canada, 1980) and the Island Lake Ojibwa (53.0%), Gods Lake Cree and Ojibwa (52.3%), and Oxford House Cree and Ojibwa (51.3%) (Grant, 1929). The Chipewayn males also have comparable SSRs of 53.8%; however, the Cree of Chipewyan have a somewhat greater mean, 55.8% (Grant, 1930). To place these comparisons within the context of the general Canadian population, the tenth, fiftieth, and ninetieth percentiles for SSR are 51.1%, 52.8%, and 54.3%, respectively, for males 20–29 years of age in the Nutrition Canada Survey of 1970–1972 (Nutrition Canada, 1980).

In females, the mean SSR for FN is 52.9%, which is also similar to a nationally representative sample of Canadian FN 20–29 years of age (53.6% [Nutrition Canada, 1980]) and the Island Lake Ojibwa (52.8%) and Gods Lake Cree and Ojibwa (52.6%) (Grant, 1929). Similar to males, the Cree females of Fond-du-lac had somewhat greater SSRs, with an average of 54.8% (Grant, 1930). The tenth, fiftieth, and ninetieth percentiles for SSR in the general Canadian population were 50.3%, 53.0%, and 55.6%, respectively, in the Nutrition Canada Survey of 1970–1972 for females 20–29 years of age (Nutrition Canada, 1980).

Results of the present study suggest that, with the exception of adult FN females who are larger overall, anthropometric differences among FN and EA are small. Unfortunately, comparative data on frame size for First Nation Canadians are scarce. Auger et al. (1980) presented biacromial and bicristal breadths for the Foxe Basin Eskimos, which average 37.8 cm and 29.4 cm in males and

TABLE 6. Stature, sitting height, and body mass in selected samples of adult First Nation Canadians

Group	Geographic location	Sample size	Ages	Stature (cm)	Sitting height (cm)	Mass (kg)	Reference
Males							
First Nation							
Mixed sample	National	69	20–29	170.2	90.1	68.3	Nutrition Canada, 1980
Athapaskan							
Slave	Upper Liard, Yukon	27	>18	169.7	—	69.6	Lee and Birkbeck, 1977
Northern Tuchone	Ross River, Yukon	11	>18	171.3	—	69.2	Lee and Birkbeck, 1977
Beaver, Cree, and Slave	Ft. St. John, British Columbia	47	>18	172.4	—	67.9	Lee and Birkbeck, 1977
Chipewyan	Lake Athabaska	44	20–59	166.4	89.4	—	Grant, 1930
Dogrib	Northwest Territories	60	≥21	165.4	—	66.6	Szathmáry and Holt, 1983
Chilcotin	Anaham, British Columbia	36	>20	170.3	90.2	70.7	Birkbeck et al., 1971
Wakashan							
Nootka	Ahousat, British Columbia	36	>20	170.4	92.3	79.6	Birkbeck et al., 1971
Algonkian							
Cree	Lake Athabaska	22	20–59	161.0	89.1	—	Grant, 1930
Cree	Fort Severn, Ontario	15	19–44	173.5	90.1	67.0	Hurlich and Steegmann, 1979
Cree and Ojibwa	Weagamow, Ontario	12	16–44	175.6	93.8	70.3	Hurlich and Steegmann, 1979
Ojibwa	Island Lake, Manitoba	62	20–59	170.0	89.9	—	Grant, 1929
Cree and Ojibwa	Gods Lake, Manitoba	12	20–59	172.0	90.0	—	Grant, 1929
Ojibwa	Temagami, Ontario	35	20–75	175.8	92.5	87.2	Present study
Females							
First Nation							
Mixed sample	National	110	20–29	158.0	84.7	61.5	Nutrition Canada, 1980
Athapaskan							
Slave	Upper Liard, Yukon	34	>18	158.3	—	61.4	Lee and Birkbeck, 1977
Northern Tuchone	Ross River, Yukon	27	>18	157.3	—	57.7	Lee and Birkbeck, 1977
Beaver, Cree, and Slave	Ft. St. John, British Columbia	43	>18	158.1	—	65.1	Lee and Birkbeck, 1977
Chipewyan	Lake Athabaska	20	20–59	150.9	82.4	—	Grant, 1930
Dogrib	Northwest Territories	97	≥19	154.5	—	58.4	Szathmáry and Holt, 1983
Chilcotin	Anaham, British Columbia	55	≥20	156.5	83.6	65.8	Birkbeck et al., 1971
Wakashan							
Nootka	Ahousat, British Columbia	45	≥20	158.3	85.7	65.6	Birkbeck et al., 1971
Algonkian							
Ojibwa	Island Lake, Manitoba	100	20–59	157.6	83.2	—	Grant, 1929
Cree and Ojibwa	Gods Lake, Manitoba	25	20–59	158.2	83.3	—	Grant, 1929
Ojibwa	Temagami, Ontario	53	20–75	162.8	75.7	75.7	Present study

34.8 cm and 28.5 cm in females, respectively. The corresponding values in the present sample of adult FN for biacromial and bicristal are 43.9 cm and 32.5 cm in males and 39.5 cm and 32.5 cm in females, respectively (Table 3). The differences probably reflect to a large extent the larger body size of the Temagami FN, as the Foxe Basin Eskimos were on average more than 10 cm shorter than the present sample (162.6 cm in males and 151.7 cm in females [Auger et al., 1980]). Thus, it is difficult to draw any conclusions about the body or frame size of First Nation Canadians relative to the general population based on available data.

Physique

The results indicated that FN were more endomorphic than EA in both youth and adults. The differences in somatotype between FN and EA female youth, though not significant, were in the same direction as the other groups. The results are consistent with a study of Alaskan Eskimos among whom men and women had a physique characterized by high endomorphy and mesomorphy (Carter and Heath, 1990). Mean adult somatotypes in Eskimos were 3.4–5.9–1.3 in males and 6.4–4.8–0.8 in females. Mean adult somatotypes in this study were

TABLE 7. Means and standard deviations for Heath-Carter anthropometric somatotype components with comparative data from two Canadian samples[1]

		Males							Females						
			Endomorphy		Mesomorphy		Ectomorphy			Endomorphy		Mesomorphy		Ectomorphy	
Age (years)	Sample	n	$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$	SD	n	$\overline{X}$	SD	$\overline{X}$	SD	$\overline{X}$	SD
15–19	EA	16	3.3	1.1	4.3	1.2	2.8	1.0	15	4.9	1.8	3.8	1.4	2.4	1.5
	FN	7	3.5	2.3	4.3	1.4	3.1	1.5	6	5.3	2.2	4.1	2.6	2.3	1.6
	YMCA-LIFE[2]	161	3.0	1.4	4.7	1.5	2.8	1.4	235	4.3	1.2	3.7	1.1	2.4	1.1
	QFS[3]	130	2.3	0.9	4.2	1.1	3.5	1.2	136	3.7	1.2	3.4	1.0	3.0	1.1
20–29	EA	34	3.7	1.5	4.9	1.6	2.4	1.4	19	5.9	2.0	4.6	1.7	1.5	1.3
	FN	11	5.1	1.7	6.2	1.8	1.3	1.2	12	6.7	2.3	5.3	2.1	1.2	1.1
	YMCA-LIFE	2,259	3.6	1.4	5.0	1.3	2.2	1.1	1,752	4.4	1.3	3.7	1.2	2.4	1.1
	QFS	45	2.6	1.2	4.6	1.3	2.9	1.3	35	3.4	1.1	3.2	1.3	3.0	1.3
30–39	EA	39	4.7	1.9	6.2	1.4	1.3	1.0	44	5.6	1.8	4.5	1.6	1.7	1.2
	FN	10	4.6	1.3	6.0	1.1	1.2	0.9	9	8.1	1.7	6.3	1.7	0.5	0.8
	YMCA-LIFE	2,985	4.0	1.4	5.2	1.2	1.8	1.0	1,201	4.6	1.4	3.9	1.2	2.3	1.1
	QFS	68	4.1	1.7	5.4	1.1	1.8	1.0	117	4.7	1.5	4.0	1.1	1.9	1.1
40–49	EA	44	4.5	1.8	5.9	1.6	1.3	1.2	34	6.4	1.7	5.0	1.9	1.5	1.2
	FN	6	5.6	1.8	6.6	1.3	0.5	0.4	10	7.5	1.4	6.2	1.3	0.4	0.4
	YMCA-LIFE	2,031	4.1	1.3	5.3	1.2	1.7	1.0	787	5.1	1.4	4.4	1.3	1.8	1.0
	QFS	233	4.0	1.5	5.6	1.0	1.5	1.0	224	5.1	1.6	4.3	1.4	1.7	1.1
50–59	EA	34	5.3	1.8	6.6	1.4	0.8	0.8	31	6.6	1.8	5.4	1.6	1.0	1.1
	FN	4	4.9	1.2	6.3	1.5	0.8	1.1	4	7.8	1.2	6.1	0.9	0.3	0.3
	YMCA-LIFE	1,159	4.1	1.2	5.4	1.2	1.6	0.9	498	5.4	1.4	4.5	1.3	1.8	1.0
	QFS	55	3.6	1.2	5.5	1.2	1.5	1.1	26	5.6	1.5	4.7	1.3	1.2	1.1

[1] EA, European ancestry; FN, First Nation ancestry; QFS, Québec Family Study; SD, standard deviation; $\overline{X}$, mean.
[2] Data from Bailey et al. (1982).
[3] Data from Katzmarzyk et al. (1998) and Malina et al. (1997).

5.2–6.2–1.0 in FN males and 7.4–5.9–0.7 in FN females. Thus, FN adults from Temagami appear to be on average somewhat more endomorphic and mesomorphic than Eskimo adults.

There are three sources of comparative somatotype data for Canadians: the YMCA-LIFE program (Bailey et al., 1982), the Canada Fitness Survey (CFS) Pérusse et al., 1988), and the Québec Family Study (Katzmarzyk et al., 1998; Malina et al., 1997). The YMCA-LIFE program was a nationwide testing program conducted in 1976–1978 to characterize the lifestyle and fitness of Canadians (Bailey et al., 1982). A large sample (13,599 subjects) of Canadians was somatotyped by the Heath-Carter anthropometric protocol as part of the YMCA-LIFE program. The CFS was conducted in 1981 and involved collecting anthropometric and fitness data on 13,804 subjects 7–69 years of age from across Canada (Pérusse et al., 1988). The anthropometric battery of the CFS included the dimensions necessary for the calculation of Heath-Carter anthropometric somatotypes. Phase I of the Québec Family Study (QFS) was conducted from 1978–1982 and included anthropometric, activity, dietary, fitness, and metabolic data on a sample of French Canadian subjects from the Greater Québec City area (Bouchard, 1996). Heath-Carter anthropometric somatotype was assessed as part of the anthropometric battery of the QFS, and the data used in the analyses of Katzmarzyk et al. (1998) and Malina et al (1997) were reanalyzed according to the age groups used in the present study for the purpose of providing comparative data.

Few data have been presented on the somatotypes in the CFS. Pérusse et al. (1988) presented mean somatotypes for the entire sample from 7–69 years of age: 3.6–4.9–2.2 for males and 4.4–4.2–2.1 for females. For the same age range in the present study, mean somatotypes were, respectively, 4.2–5.6–1.8 and 5.0–5.7–1.5 for EA and FN males and 5.7–4.7–1.7 and 6.7–5.3–1.3 for EA and FN females. The EA sample in the present study is more endomorphic and mesomorphic and slightly less ectomorphic than the CFS sample, while the FN sample is considerably more endomorphic and mesomorphic and less ectomorphic than the CFS sample.

Table 7 presents mean Heath-Carter anthropometric somatotypes for this study, the YMCA-LIFE program (Bailey et al., 1982), and the QFS (Katzmarzyk et al., 1998; Malina et al., 1997) by age group and sex. The QFS group is less endomorphic and more ectomorphic than the other samples in the 15–19 and 20–29 year age groups; thereafter, the QFS means are similar to those for the YMCA-LIFE program. The FN sample is consistently more endomorphic and mesomorphic and less ectomorphic than the other samples, especially in the older age groups. Similarly, the EA group tends to approximate the means of the YMCA-LIFE program in the 15–19 and 20–29 year age groups; thereafter, the EA sample consistently demonstrates higher endomorphy and mesomorphy than the other samples, with the exception of the FN. Thus, in the present sample, the FN are more endomorphic than EA and the FN are more endomorphic than comparative data from other large samples in Canada.

CONCLUDING REMARKS

As in many studies of FN groups, the interpretation of the results of the present study is limited by the small sample size. However, the sample comprised about 50% of the available population. Given that the sample population is from a restricted geographical location in a somewhat remote region of Northern Ontario, the results may not be generalizable to all FN groups in Canada. Further work is required to better characterize the body size and physique of FN Canadians using larger population studies.

Given the time frame over which FN anthropometric data have been reported in Canada (1929–1997) and the use of small isolated samples, it is uncertain whether a secular trend in body size has occurred in the FN, both in the present sample and in other groups as well. Nevertheless, the FN of Temagami have considerably larger body sizes than have been reported in the literature to date. It is also of note that the Temagami EA also have large body sizes relative to the reference data. Given that the reference data were collected in 1981 (Fitness Canada, 1985), it is uncertain whether the larger body sizes observed in Temagami are due to a recent secular trend in Canada or to regional variation in body size.

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